



## PHENIX HBD GAS SYSTEM OPERATION PROCEDURE

**PHENIX Procedure No. PP-2.5.2.3-02**

**Revision: B**

**Date: 1/08/2010**

<b><u>Hand Processed Changes</u></b>			
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### **Approvals**

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PHENIX S E & I      Date

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Cognizant Scientist/  
Engineer/Activity Manager      Date

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PHENIX Safety      Date

Preparer(s): Leonid Kotchenda  
Robert Pisani

REVISION CONTROL SHEET

LETTER	DESCRIPTION	DATE	AUTHOR	APPROVED BY	CURRENT OVERSIGHT
A	First Issue	12/15/06	R. Pisani	D.Lynch, P.Giannotti, R. Pisani	R. Pisani
B	Reviewed for accuracy and found to be acceptable. Changed Responsible persons list (Appendix 2) to web link information.	1/08/2010	R. Pisani	D. Lynch, P. Giannotti, R. Pisani	R. Pisani

## **1.0 Purpose and Scope**

The goal of this procedure is to instruct PHENIX personnel in the correct procedure for starting the HBD gas system and for purging the HBDs(West and East) with dry Argon prior to the introduction of CF<sub>4</sub> gas.

This procedure contains the steps necessary to start the HBD gas system from a fully shutdown state and to purge the HBDs and secondary systems with dry Argon. In this operation, Argon gas is routed from a tank that resides on the gas pad outside of the PHENIX Mixing House (MH), through all portions of the HBD gas system and then into the HBDs itself. The gas from the HBDs is vented to the Vent line outside MH. The gas flow will be less than 5 liters per minute (LPM).

The primary purpose of purging the HBDs with dry Argon is to support the Oxygen and Water content below 2 ppm. At the end of this procedure the HBDs can be maintained in a standby state with a low flow of Argon or the operator can continue on and purge with CF<sub>4</sub>.

In addition to the Operating Procedures this document specifies the Local Emergency Plan of the HBD. This Local Emergency Plan will ensure:

- 1.1 The safety of all personnel from risks associated with the operation of the HBD gas system
- 1.2 The implementation of the appropriate emergency procedures
- 1.3 Prompt notification of the appropriate C-A and S&EP specialists
- 1.4 The maintenance of appropriate C-A emergency status
- 1.5 The preservation and protection of the environment
- 1.6 The preservation of BNL facilities and equipment

## **2.0 Responsibilities**

During PHENIX operations, there will be two levels of responsibility for the oversight of the HBD gas systems: the PHENIX shift crew and the PHENIX GAS experts.

The first level of responsibility resides with the PHENIX Shift Crew. During any period when the HBD has flammable gas flowing or HV on, there will be a minimum of two people on continuous shift in the PHENIX counting house. Once data taking starts, the

number of people on shift at PHENIX will increase to five. The second level of responsibility resides with the PHENIX gas experts. The gas experts will be on-call to respond to any alarm or unusual occurrence detected by the PHENIX shift crew. A record of the performance of the HBD gas system will be maintained and monitored by the gas system experts and shift crew.

During watch shifts or data taking, it will be the responsibility of the PHENIX Shift Crew to:

**2.1 Monitor the status and alarms for the gas system.**

**2.2 In the event of an alarm or unusual occurrence, contact an expert from the Expert Call List.**

The second level of responsibility is the gas experts. It is the responsibility of the Gas experts to:

**2.3 Maintain the HBD Gas System in a safe operating condition. This includes:**

- 2.3.1 Changing gas cylinders and dewars when required
- 2.3.2 Setting, adjusting, and checking the gas mixture, flow rates and pressures.
- 2.3.3 Checking the certification of the operating gas (see details in Precautions, Section 4)
- 2.3.4 Posting any special instructions or notifications as required
- 2.3.5 Carrying out any emergency actions, as prescribed in the Procedures section of this document.

See Attachment 2 for additional information

### **3.0 Prerequisites**

The HBD Gas Expert shall have read or have training in the following areas:

- 3.1 PHENIX Local Emergency Plan, RHIC-OPM 3.16,
- 3.2 BNL Compressed Gas Safety Training Course,
- 3.3 BNL Electrical Safety I
- 3.4 RHIC/PHENIX access training
- 3.5 BNL Haz-com

### 3.6 BNL General Employee Training

## 4.0 Precautions

### 4.1 Gas System Precautions:

- 4.1.1 All gas cylinder storage is on the PHENIX Gas pad located just south and east of Building 1008 F, the PHENIX Gas Mixing Hut. All gas cylinders and dewars are to be changed by **authorized** PHENIX personnel with current BNL Compressed Gas Safety Training.
- 4.1.2 All valves and controls associated with the TOF.W Gas system are to be operated ONLY by **authorized** gas system experts with current training.
- 4.1.3 Primary care should be given to monitoring the internal pressure of the TOF.W throughout the duration of the start-up procedure, especially when adjusting flow rates. Over-pressurization of the TOF.W (above 3" WC) can result in structural damage to the detector.
- 4.1.4 **Before any HV can be turned on, sufficient operating gas must have flowed through each of the detectors for 4 volume exchanges. The total gas volume of all TOF.W detectors on the West carriage is 225 liters. The TOF.W HV is to be turned on only by a TOF.W HV expert with current training.**
- 4.1.5 Any reconfiguration or adjustment to the TOF.E Gas System in the PHENIX IR or mixing house is to be performed ONLY by an **authorized** TOF.W Gas System expert with current training.

**NOTE: Over pressurization of the HBD(above 2"WC) will result in severe structural damage. Primary care should be given to monitoring the internal pressure of the HBD throughout the duration of this procedure, especially when adjusting flow rates.**

## 5.0 Procedure -- Purging the HBDs with dry Argon

### 5.1 Power on the Gas System

- 5.1.1 Turn on AC power for Electronic and Gas Racks(breaker on top of Electronic Rack) and boot PC soft.

**NOTES:**     *1. All solenoid valves, mass flow controller and compressors are controlled with the gas system PC.  
2. HBD is supplied with Argon gas through temporary gas system.  
3.HBD Gas system was cleaned and adjusted before the connection to the HBD.*

5.1.2 Turn on AC power for Oxygen and H2O analyzers, FM1 power Supply (Electronic Rack)

5.2     Prepare for Argon Flow

5.2.1 Confirm that FI1, FI3 and MV1 are closed.

5.2.2 Confirm that MBV1 is closed

5.2.3 Confirm that Argon is connected to CF4 supply line on gas pad.

5.2.4 In the gas rack adjust pressure regulator to 15 PSIG indicated on PI1

5.3     Flow Argon

5.3.1 Slowly open FI1 and set flow 1.5LPM.

5.3.2 Confirm flow on FI6.

5.3.3 Set Argon flow through the temporary system 1LPM.

5.3.4 Confirm that SV13 is opened

5.3.5 Connect the return line to the gas system.

5.3.6 Check HBDs pressure PT7, PT8 on PC.

**CAUTION**

**Structural damage to the HBDs can result for a pressure > 2.0"WC. If the pressure becomes too high, reduce the flow. After starting or changing flow, wait and observe the pressure rise on PT7 and PT8. To maintain a margin of safety, pressure for this procedure should not exceed 1"WC(PT7,PT8) at the**

**maximum flow.**

- 5.3.7 Confirm that Argon flow on FI1 is 1.5LPM
- 5.3.8 Open SV6
- 5.3.9 Check Oxygen and Water content.
- 5.3.10 If Oxygen and Water content is below 1ppm, close SV6 and connect supply line to the gas system
- 5.3.11 Check HBDs pressure readings PT7, PT8 on PC. They should not exceed 1"WC
- 5.3.12 At HBDs pressure(PT7,PT8) below 0.5"WC increase FI1 flow to have 0.8"WC

**NOTE At this point, there are two options. To maintain HBDs in a standby mode with dry Argon. To continue on and prepare to flow CF4 gas.**

## **6.0 Operating the PHENIX HBD Gas System with CF4 Gas**

### **6.1 Purpose and Scope**

The scope of this portion of the OPM is those operations that are necessary for running the PHENIX Hadron Blind Detector(HBD) with CF4 Gas using the HBD gas system. Operations in this procedure include the following:

1. Purging the HBD with CF4 Gas.
2. Fractional CF4 recirculation for long term running.

In the operation described here CF4 gas is routed from the gas storage pad and sent to the HBD. For long term operation, the gas is fractionally recirculated, with a portion vented to atmosphere outside the mixing room and an equal amount of fresh gas added. The gas flow in the HBD is typically 4-6 lpm at a pressure

of 0.8"WC. Critical pressures and flows of the gas system are monitored by a computer program..

The primary purpose of this operation is to initiate and maintain CF<sub>4</sub> gas in the HBD with low levels of oxygen and water (<1.0 ppm) for the duration of the PHENIX operations.

## **6.2    Precautions**

- 6.2.1    Overpressurization of the HBD (above 2"WC) will result in severe structural damage. Primary care should be given to monitoring the internal pressure of the HBD throughout the duration of this procedure, especially when adjusting flow rates and when the software alarms are bypassed.

## **6.3    Procedure- Initial Setup with CF<sub>4</sub>**

**NOTE            The following procedure assumes that the HBDs have been flushed with Argon and that auxiliary system have been turned on.**

- 6.3.1    Connect CF<sub>4</sub> instead of Argon to the gas system.
- 6.3.2    Set FI1 flow to 4LPM
- 6.3.3    Flash 6 HBDs volumes with CF<sub>4</sub>.
- 6.3.4    Open Valve on the air supply line to PID Controller
- 6.3.5    Open MV1
- 6.3.6    Open MBV1(FI6 flow should drop on 1CFH) and purge lines to Vent line for 1 minutes.



- 6.3.7 Close MBV1
- 6.3.8 Open SV4
- 6.3.9 Open MV8(Dryers OUT)(FI6 flow should drop on 1-2CFH) and purge  
Purifier1/Dryer1 for 5 minutes)
- 6.3.10 Close MV8
- 6.3.11 Change positions of MV2,MV3,MV4,MV5 to Purifier 2/Dryer2
- 6.3.12 Open MV9
- 6.3.13 Open MV12(FI6 flow should drop on 1-2CFH) and purge  
Purifier2/Dryer2 for 5 minutes).
- 6.3.14 Close MV12
- 6.3.15 Close MV9
- 6.3.16 Confirm that FI3 is closed
- 6.3.17 Open MV11
- 6.3.18 Change positions of MV2,MV3,MV4,MV5 to Purifier 1/Dryer1
- 6.3.19 Turn On TIC2
- 6.3.20 Change position MV2 to Purifier 2
- 6.3.21 Open SV6
- 6.3.22 Close SV3
- 6.3.23 Open FI3
- 6.3.24 Open MBV1
- 6.3.25 Adjust FI4 and FI5 flow to 0.2LPM

6.3.26 Purge Analyzers up to readings of 2ppm.

**NOTE At this point the gas system is ready for the recirculating mode.**

### **6.3 Putting the system in CF 4 Recirculation**

**6.3.1** Set PID Controller set point to 0.4"WC

**6.3.2** Change position MV2 to Purifier 1

**6.3.3** Open MV9 and MV10

**6.3.4** Close MV11

**6.3.5** Open SV7 and SV12

**6.3.6** Close SV8 and SV10

**6.3.7** Close SV9 and SV 11

**6.3.8** Close SV1

**6.3.9** Set FM1 flow to 1LPM

6.3.10 Close SV13

6.3.11 Start Compressor 1 or 2 at 0.7"WC PT4

6.3.12 Set FI4 and FI5 flows to 1LPM

6.3.13 Using MBV1 and BPCV1 adjust PI3 to 100-110"WC

6.3.14 Using MBV1 adjust PT4 to 0.4"WC

6.3.15 Purge supply lines up to Water and Oxygen level of 1ppm

**CAUTION**

**Structural damage to the HBD can result for a pressure > 2”WC  
If the pressure becomes too high, reduce the flow.  
After starting or changing flow, wait and observe the pressure  
rise on PT7,PT8 (HBDs pressure).**

6.3.16 Open SV9 and SV11

6.3.17 Open SV8 and SV10

6.3.18 Close SV7 and SV12

6.3.19 Adjust flow through FI3 to 4.5- 5LPM

6.3.20 Confirm that FI6 flow is as FI3

6.3.21 In the gas system control program, push the “disable alarms” button

**NOTE:** Use MV1 and SV3 to reduce the flow through  
Purifiers/Dryers.

#### **6.4 Stopping of Recirculation Mode and purging with Argon**

6.4.1 In the gas system control program, push the “enable alarms” button

6.4.2 Connect Argon instead of CF4 to the gas system.

6.4.3 Open SV13

6.4.4 Stop running Compressor

6.4.5 Open SV1

6.4.6 Set FI1 flow to 4LPM

6.4.7 Set FI4 and FI5 flows to 0.2LPM

6.4.8 Close SV2

6.4.9 Turn off TIC2

- 6.4.10 Change position MV2 to Purifier 2
- 6.4.11 Close MV9 and MV10
- 6.4.12 Open MV11
- 6.4.13 Close MV1
- 6.4.14 Open SV3
- 6.4.15 After 2 hours close SV4
- 6.4.16 Change position MV2 to Purifier 1
- 6.4.17 Close MV11
- 6.4.18 Close Valve of air supply line to PID Controller

## **7.0 Documentation**

- 7.1 All notes and observations should be recorded in the PHENIX gas system checklist. A gas system log sheet should be completed every 4 hours and entered into the gas checklist online database.

## **8.0 Attachments**

- 1. HBD Gas System Acronym Glossary
- 2. Responsible People/Operators
- 3. HBD Drawing

Attachment 1

HBD GAS SYSTEM ACRONYM GLOSSARY

BPCV	Back pressure control valve
CV	Check valve
F	Filter
FI	Flow indicator
FM	Mass flow controller
MV	Manual valve
PCV	Pressure control valve
PI	Pressure indicator
PT	Pressure transmitter
SV	Solenoid valve
T	Temperature transmitter
H	Heater
MBV	Manual Bypass Valve

Attachment 2: Responsibilities

**Contact Information**

Contact Information for experts for this subsystem can be found on the PHENIX Internal Website in the [RUN] link at: (NOTE: replace ## by the current run number)

**[https://www.phenix.bnl.gov/WWW/run/##/contacts/subsys\\_experts.html](https://www.phenix.bnl.gov/WWW/run/##/contacts/subsys_experts.html)**

General PHENIX contact info can similarly be found at:

**<https://www.phenix.bnl.gov/WWW/run/##/contacts/>**

Gas system experts can be found at:

**[http://phenix.bnl.gov/WWW/tracking/gas\\_system/people.html](http://phenix.bnl.gov/WWW/tracking/gas_system/people.html)**

In addition, the Run Coordinator and Shift leader for the current run shall have a paper copy available of the contact information for the appropriate systems experts for this and all other PHENIX subsystems.

## HBD GAS System Drawing

